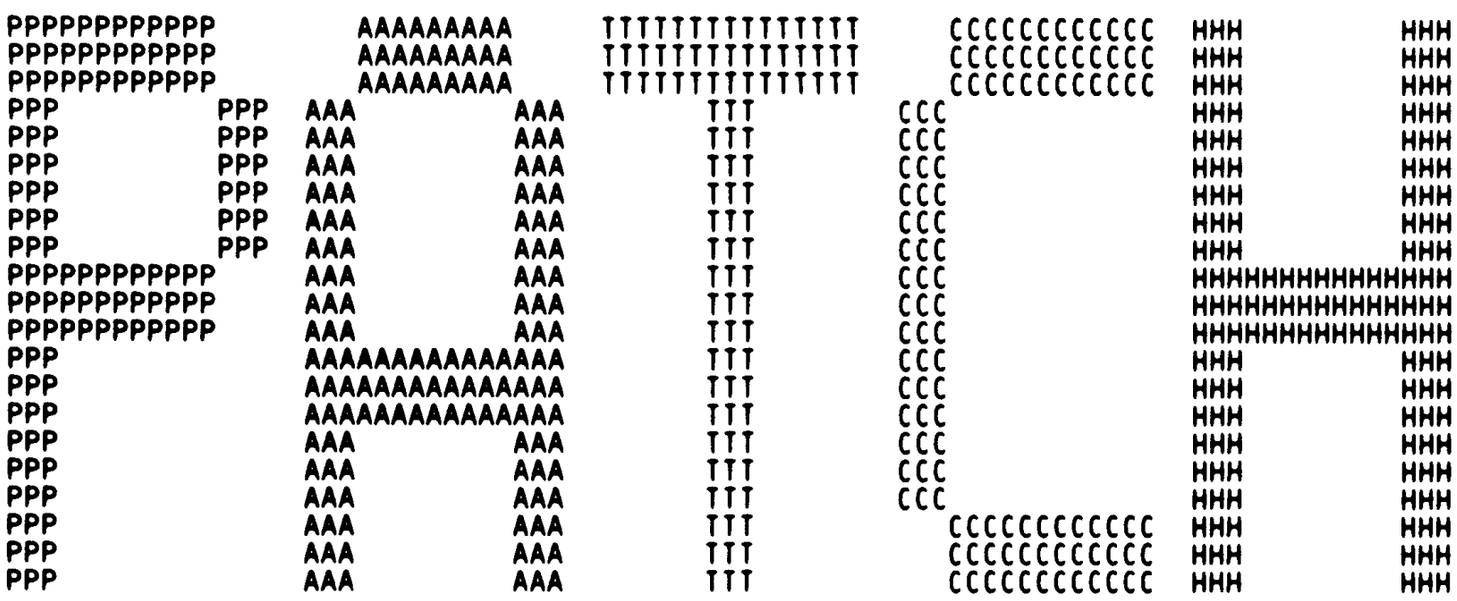
PPPPPPPPPPPP AAAAAAAAA TTTTTTTTTTTTTTT CCCCCCCCCCCC HHH HHH
PPP PPP AAA AAA TTT CCC HHH HHH
PPPPPPPPPPPP AAAAAAAAAAAAAAAA TTT CCC HHHHHHHHHHHHHHHH
PPP AAA AAA TTT CCC HHH HHH
PPP AAA AAA TTT CCCCCCCCCCCC HHH HHH

```
PPPPPPPP      AAAAAA    TTTTTTTTTT  RRRRRRR    TTTTTTTTTT    SSSSSSS
PPPPPPPP      AAAAAA    TTTTTTTTTT  RRRRRRRR   TTTTTTTTTT    SSSSSSS
PP       PP  AA      AA      TT      RR      RR      TT      SS
PP       PP  AA      AA      TT      RR      RR      TT      SS
PP       PP  AA      AA      TT      RR      RR      TT      SS
PP       PP  AA      AA      TT      RR      RR      TT      SS
PPPPPPPP     AA      AA      TT      RRRRRRRR        TT       SSSSSS
PPPPPPPP     AA      AA      TT      RRRRRRRR        TT       SSSSSS
PP           AAAAAAAAAA      TT      RR  RR          TT             SS
PP           AAAAAAAAAA      TT      RR  RR          TT             SS
PP           AA      AA      TT      RR    RR        TT             SS      ....
PP           AA      AA      TT      RR    RR        TT             SS      ....
PP           AA      AA      TT      RR      RR      TT      SSSSSSSS       ....
PP           AA      AA      TT      RR      RR      TT      SSSSSSSS       ....
```

```
RRRRRRRR    EEEEEEEEEE    QQQQQQ
RRRRRRRR    EEEEEEEEEE    QQQQQQ
RR      RR  EE            QQ      QQ
RR      RR  EE            QQ      QQ
RR      RR  EE            QQ      QQ
RR      RR  EE            QQ      QQ
RRRRRRRR    EEEEEEEE      QQ      QQ
RRRRRRRR    EEEEEEEE      QQ      QQ
RR  RR      EE            QQ  QQ  QQ
RR  RR      EE            QQ  QQ  QQ
RR    RR    EE            QQ    QQ
RR    RR    EE            QQ    QQ
RR      RR  EEEEEEEEEE    QQQQ  QQ
RR      RR  EEEEEEEEEE    QQQQ  QQ
```

```
!++
!  PATRTS.REQ - RunTime Symbol Table Literals and Structures
!       Version V03-002
```


```
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!****************************************************************************
```


```
!  Revision History:
!
!  NO   DATE            PROGRAMMER          PURPOSE
!  --   ----            ----------          -------
!
!  00   20-DEC-77       K.D. MORSE          ADAPT VERSION V04-000 FOR PATCH.
!  01   27-DEC-77       K.D. MORSE          CHANGE DBG$_RST_BEGIN TO BE
!                                           GLOBAL PAT$GL_RST_BEGN, THAT
!                                           IS INITIALIZED IN PAT$FREEINIT.
!  02   11-JAN-78       K.D. MORSE          ADD FIELDS FOR DSTR ACCESS.
!  03   28-FEB-78       K.D. MORSE          ADD RST SIZE LITERALS.
!  04   08-MAR-78       K.D. MORSE          ADD SYMBOL DSC$W_MAXLEN DUE
!                                           TO NEW SRMDEF.MDL WHICH DOES
!                                           NOT INCLUDE IT.
!  05   18-MAR-78       K.D. MORSE          REMOVED ALL DSC DEFINITIONS
!                                           AS THEY ARE NOW IN SRMDEF.MDL
!                                           EXCEPT PATCH MIN AND MAX VALUES.
!  06   06-apr-78       K.D. MORSE          CHANGE GST_E_NAME_ADDR FROM 10 TO 12.
!                                           ADD NEW FIELDS FOR MC_GBLxxx AND
!                                           NEW DSC$... FOR GSD TYPES.  NEW
!                                           MC_GBL_LOCKED FIELD TELLS SYM_TO_VAL
!                                           WHEN IT IS OK TO CONSULT THE GST.
!
!  Modified by:
!
!       V03-002 MTR0022         Mike Rhodes      3-May-1983
!               Change runtime symbol table name table entry size to correctly
!               reflect symbol size (symbols upto 31 characters).
```

```
!       V03-001 MTR0012         Mike Rhodes     16-Aug-1982
!               Modify file names to remove duplicate file names between code
!               and require files.
!
! 1.07  CNH0027         Chris Hume      6-Jan-1980      18:00
!       Pulled some definitions for the DSC structure that were added
!       to the system libraries.
!--
```

```
!++
! Since the PATCH free-storage manager currently
! works in 'units', we define the following macro to
! convert a byte-unit quantity into whatever units it
! requires.  We expect to change the free-storage manager
! to work in byte units, so eventually this macro should
! just reduce to its actual parameter.  For now, however,
! it 'rounds up' to the smallest number of LONGWORDS
! which are required to contain the indicated number of
! bytes.
!--

MACRO
        RST_UNITS( bytes ) =

                ( ((bytes) + %upval-1)/%upval )
        %;

!
! MACROS:
!

MACRO
        YES_NO( question )

                ! Ask a question and return the Y/N answer.
                =
                QUERY( UPLIT( %ASCIC question )) %;
```

```
!++
! RST-Pointers
!
! So-called RST-pointers are referred to throughout the RST
! code.  They are simply the means of access to RST data
! structures, and we purposely talk of them as if they were
! their own TYPE so that we can change this implementation
! detail if/when we feel it is necessary.
!
! For now, RST-pointers are 16-bit items which are manipulated by
! the special RST storage routines PAT$RST_FREEZ and PAT$RST_RELEASE.
! No code outside of the RST-DST/PATCH interface module knows
! anything more about the implementation of RST-pointers than that.
! (Other modules declare and use RST-pointers via macros, etc.)
!
! If any change is to be made to what RST-pointers actually
! are, there are only 2 criterior that the new ones much uphold:
! 1) RST-pointers must be storable in the NT, MC, SAT and LVT fields
! which are defined for them, and 2) they must be able to provide
! access to the RST_NT and RST_MC structures defined below.
!
! The following macro is provided so that one can declare REFs
! to such pointers.  Some code also applies %SIZE to this macro
! to get the size of an RST-pointer.  Note that no code should
! declare an occurrence of an RST-pointer, since we do not define
! that you can do anything meaningful with such a thing.  This is
! because we want to enforce the usage of REFs to the structures
! we declare to access RST data structures.  (e.g. we use
! "REF MC_RECORD" to say that we are declaring a pointer to
! an MC record.  REFs to MC_RECORDS also happen to be RST-pointers,
! but we don't want to build-in this coincidental characteristic.)
!--

MACRO
        RST_POINTER = VECTOR[1,WORD] %;
```

```
!++
! Pathnames
!
! Symbols in PATCH are actually made up of sequences of
! symbols or "elements".  The concatenation of such
! elements, along with the element separation character (\), make
! up a so-called pathname because the sequence represents the
! path which one must make thru RST data structures to get to
! the desired symbol.
!
! We represent strings internal to PATCH by passing around
! so-called counted string pointers.  They are simply LONGWORD
! pointers to a count byte followed by that many characters.
! The CS_POINTER macro allows us to declare occurrences, REFs,
! and take the %SIZE of this type of datum.
!
! Pathnames, then, are represented with vectors of CS_POINTERS.
! Like duplication vectors, they terminate with a 0 entry
! for programming ease, but also have a maximum size so that
! we can declare them LOCALly.
!
! The following macros are used in declarations to not build-in
! the above conventions.
!--

MACRO
                                ! PATCH tells the RST module about ASCII
                                ! strings by passing a counted string pointer.
        CS_POINTER      = REF VECTOR[1,BYTE] %;

                                ! Symbol pathnames are 0-ended vectors
                                ! of CS_POINTERs.  There is a maximum
                                ! length to pathnames so that routines can
                                ! declare LOCAL vectors of pathname pointers.
LITERAL
        MAX_PATH_SIZE   = 10;
MACRO
        PATHNAME_VECTOR = VECTOR[ MAX_PATH_SIZE +1, %SIZE(CS_POINTER) ] %;
```

```
!++
! Overall Characteristics of the RST/DST, etc.
!--

!++
! The PATCH Runtime Symbol Table (RST) free-storage area
! begins at a fixed virtual address.  This GLOBAL is used
! directly by some of the RST structures since RST-pointers
! need this information.
!
!--

LITERAL
        ! THE RST IS A FIXED SIZE BUT THIS FACT IS ONLY USED TO
        ! ALLOW THE INITIALIZATION OF THE OTHER  SIZE LITERALS.
        ! THESE LITERALS ARE USED TO LIMIT THE AMOUNT OF RST STORAGE
        ! ALLOCATED FOR VARIOUS PARST OF THE RST.

        RST_TOTAL_SIZE  =       65000,                          ! RST IS 65K BYTES

        ! THE "SET MODULE" COMMAND DOES NOT ALLOCATE ALL THE FREE STORAGE
        ! AVAILABLE IN THE RST.  INSTEAD, MODULES WILL BE ADDED AS LONG AS
        ! THERE IS AT LEAST RST_AVAIL_SIZE BYTES AVAILABLE IN THE RST.

        RST_AVAIL_SIZE  =       3000,                           ! STORAGE LEFT FOR PATCH ITSELF

        ! DURING THE RST INITIALIZATION, SPACE IS TAKEN TO SET AS MANY MC'S
        ! AS WILL LEAVE RST_MODU_SIZE BYTES FOR SUBSEQUENT SET MODULE COMMANDS.
        ! CURRENTLY THE MC SPACE IS 50% OF THE RST.

        RST_MODU_SIZE   =       (RST_TOTAL_SIZE-RST_AVAIL_SIZE)/2,

        ! The SAT and LVT are allocated contiguous storage
        ! by tallying up the number of entries in each table
        ! we will get from each module we are to initialize.
        ! The following two minimums are used to begin the
        ! tally so that the tables will actually be somewhat
        ! larger than what the MC data implies.  The SAT and LVT
        ! minimums must be at least 1 so that we will never ask
        ! the free storage manager for 0 bytes.

        SAT_MINIMUM     = 10,   ! Minimum number of SAT entries.
        LVT_MINIMUM     = 10,   ! Minimum number of LVT entries.

        ! The NT, however, has no such fixed size.  MC statistics
        ! gathering tallies up the number of NT entries, though;
        ! we begin such a tally at NT_MINIMUM.

        NT_MINIMUM      = 0,    ! Minimum number of NT entries.

        ! We will use byte indices to fetch RST-pointers to the NT
        ! from the NT hash vector.  This vector, then, must contain
        ! NT_HASH_SIZE entries, each of which must be large enough
        ! to store an RST-pointer.  See BUILD_RST() in DBGRST.B32
        ! Also see field NT_FORWARD of the NT record definition,
        ! and the corresponding warning in the routine UNLINK_NT_RECS.
```

```
        NT_HASH_SIZE    = %X'FF',       ! NT hash vector size.

        ! We will never print "symbol+offset" when the
        ! upper bound for "symbol" is 0 and when
        ! the offset is greater then RST_MAX_OFFSET

        RST_MAX_OFFSET          = %X'100';


!+
! Since scope definitions are recursive, we must
! stack ROUTINE BEGINs in the routine ADD_MODULE.
! It is no coincidence that this stack limit is the
! same as the limit on the length (in elements) of
! symbol pathnames.
!-

LITERAL
        MAX_SCOPE_DEPTH = MAX_PATH_SIZE;        ! Routines can be nested to a maximum depth.
```

```
!++
!  Descriptors
!
!  Just as the SRM defines various 'system wide' descriptor
!  formats, the RST modules use a few more descriptors
!  of its own invention.  They are as follows:
!--

!++
!  Value Descriptors
!
!  Value Descriptors are used to pass around all needed
!  information about a value which has been obtained
!  from the RST data base.  For now they are simply
!  2-longword blocks:
!
!       !-----longword------!
!
!                 !---------!
!                 ! NT_PTR  !
!       !-------------------!
!       !  actual value     !
!       !-------------------!
!
!  Value Descriptors must be accessed via the following
!  field names.
!--

FIELD
        VALU_FIELD_SET =
    SET
        VALU_NT_PTR     = [  0,0,16,0 ],        ! Associated NT pointer.
        VALU_VALUE      = [  2,0,32,0 ]         ! The actual value.
    TES;

!+
! Declare an occurrence or REF to a VALUE_DESCRIPTOR
! via the following macros.
!-

LITERAL
        VALU_DESC_SIZE  = 8;            ! Each one is 2 longwords long.

MACRO
        VALU_DESCRIPTOR = BLOCK[ VALU_DESC_SIZE, BYTE ] FIELD( VALU_FIELD_SET ) %;
```

```
!++
!  Array Bounds Descriptor
!
!  An array bounds Descriptor is used to pass around all needed
!  information about an array and its associated dimensions.
!  Like VALU_DESCRIPTORs, they are simply 2-longword blocks,
!  but this might change.
!
!       !------longword------!
!
!       !--------------------!
!       ! address of array   !
!       !--------------------!
!       ! length of array    !
!       !--------------------!
!
!  Such Descriptors must be accessed via the following
!  field names.
!--

FIELD
        ARRAY_BNDS_SET =
    SET
        ARRAY_ADDRESS   = [  0,0,32,0 ],        ! Beginning address of array.
        ARRAY_LENGTH    = [  4,0,32,0 ]         ! Size, in bytes, of array.
    TES;

!+
! Declare an occurrence or REF to an array bounds
! descriptor via the following macros.
!-

LITERAL
        ARRAY_BNDS_SIZE = 8;            ! Each one is 2 longwords long.

MACRO
        ARRAY_BNDS_DESC = BLOCK[ ARRAY_BNDS_SIZE, BYTE ] FIELD( ARRAY_BNDS_SET ) %;
```

```
!++
!  Vector Storage Descriptors
!
!  So-called "vector storage" is the storage which
!  we allocate in relatively large chunks for the
!  explicit purpose of subsequently re-allocating the same storage
!  to someone else in smaller, variable-sized chunks.
!
!  This facility has been implemented to interface between
!  the way that the standard PATCH storage manager
!  works, with the way that the RST routines really
!  want to 'allocate' storage.  We satisfy the former by
!  only asking for large chunks (and paying the
!  associated overhead), and we satisfy the latter by
!  'doling' out small-sized chunks with little overhead.
!  We can do this because we never have to freeup these
!  chunks so don't have to store the would-be-needed pointers, etc.
!
!       !--%size(RST_POINTER)--!
!
!       !- ---(i.e. word)------!
!
!                  !----------!
!                  ! PTR type !
!       !----------------------!
!       ! beginning of STORage !
!       !----------------------!
!       !   end of STORage     !
!       !----------------------!
!       ! nxt free rec in STOR !
!       !----------------------!
!
!  Such descriptors are accessed via the
!  following field names.
!
!  The 'begin' field is the one which various routines
!  look at to decide if the field descriptor is valid.
!--

FIELD
        STOR_DESC_SET =
    SET
        STOR_LONG_PTRS  = [  0,0, 8,0 ],        ! Pointer type. 1 => full word pointers,
                                                !   0 => RST-pointer access.
        STOR_BEGIN_RST  = [  1,0,16,0 ],        ! RST pointer to beginning of storage.
        STOR_END_RST    = [  3,0,16,0 ],        ! RST pointer to end of storage.
        STOR_MARKER     = [  5,0,16,0 ]         ! Current place in storage.
                                                ! (RST pointer to next available byte).
    TES;

!+
! Declare an occurrence or REF to a vector storage
! descriptor via the following macros.
!-

LITERAL
```

```
        STOR_DESC_SIZE = 7;             ! 3 RST pointers take 6 bytes;
                                        !   the pointer-type byte takes 1 more.

MACRO
        VECT_STORE_DESC = BLOCK[ STOR_DESC_SIZE, BYTE ] FIELD( STOR_DESC_SET ) %;
```

```
!++
!  The Module Chain (MC) is a chain of fixed-size
!  records each of which has an RST_MC structure:
!
!        !<byte><byte>!<byte><byte>!
!
!        !------------!------------!
!        !x!flags!type! Next MC     !
!        !------------!------------!
!        !       DST Pointer        !
!        !------------!------------!
!        !   number of NT entries   !
!        !------------!------------!
!        ! first name bytes ! count !
!        !------------!------------!
!        !     more  name  bytes    !
!        !------------!------------!
!        !     more  name  bytes    !
!        !------------!------------!
!        !     more  name  bytes    !
!        !------------!------------!--------------!
!        ! vector storage descriptor for NT recs  !
!        !------------!------------!--------------!
!        ! vector storage descriptor for SAT recs !
!        !------------!------------!--------------!
!        ! vector storage descriptor for LVT recs !
!        !------------!------------!--------------!
!        !   number of SAT entries  !
!        !------------!------------!
!        !   number of LVT entries  !
!        !------------!------------!
!
!    The reason for using our own structure here,
!    (instead of a BLOCK), is because we access
!    MC records with RST-pointers.
!--

LITERAL
                                ! MC records are fixed-size.
        RST_MC_SIZE     = 57;   ! Each one takes this many bytes.

STRUCTURE
        RST_MC [ off, pos, siz, ext; N=1, unit=1 ] =
                [ N * RST_MC_SIZE ]

                BEGIN
                (
                EXTERNAL PAT$GL_RST_BEGN;
                RST_MC + .PAT$GL_RST_BEGN
                ) + off*unit
                END <pos, siz, ext>
                ;

!+
!  MC records have the following fields.
!-
```

```
FIELD
        MC_FIELD_SET =
    SET
        ! **** Some fields (up to NAME_ADDR) must be alligned
        !      with the corresponding ones in RST_NT structures.

        MC_NEXT         = [  0,0,16,0 ],        ! Next MC record in chain.
        MC_TYPE         = [  2,0, 8,0 ],        ! DST record type byte.
                                                ! Must be DSC$K_DTYPE_MOD
        MC_IS_GLOBAL    = [  3,0, 1,1 ],        ! 0, for 'normal' MCs.  1 for the
                                                !  MC record we 'hang' globals off.
        MC_IN_RST       = [  3,1, 1,1 ],        ! Whether or not this module
                                                !   has been initialized into the RST.
        MC_IS_MAIN      = [  3,2, 1,1 ],        ! Whether or not this module
                                                !   contains the program's transfer
                                                !   address.
        MC_GBL_LOCKED   = [  3,2, 1,1 ],        ! 1 = Do not look at GST, 0 = OK.
                                                ! This is for SYM_TO_VAL, and
                                                ! applies to the global MC only.
        MC_LANGUAGE     = [  3,3, 3,0 ],        ! 3-BIT encoding of the language
                                                ! which the module is written in.
        MC_IS_DYING     = [  3,6, 1,0 ],        ! Vector storage for this MC is
                                                !  about to be freed up.
        MC_not_free     = [  3,7, 1,0 ],        ! Used in NTs only.
        MC_DST_START    = [  4,0,32,0 ],        ! Record ID of first record for this module.
        MC_GBL_NT_PTR   = [  4,0,16,0 ],        ! Pointer to the single 'fake'
                                                ! NT record for globals.  NOTE:
                                                ! _NT_PTR and _DST_START are
                                                ! mutually exclusive.
        MC_NAMES        = [  8,0,32,1 ],        ! Number of NT records required.
        MC_NAME_CS      = [ 12,0, 8,0 ],        ! Name of Module is a counted string.
                                                ! A dotted reference to this field picks
                                                ! up the count, an undotted one
                                                ! addresses the counted string.
        MC_NAME_ADDR    = [ 13,0, 8,0 ],        ! The name string itself.  An undotted
                                                ! reference to this field addresses
                                                ! only the MC name, a dotted reference
                                                ! picks up the 1st character of the name.

        ! *** leave up to byte 27 inclusive for _NAME_ field.

        MC_NT_STORAGE   = [ 28,0, 8,0 ],        ! Vector storage descriptor for NT records.
                                                ! A direct reference to this field is
                                                !  equivalent to the STOR_LONG_PTRS
                                                !  field of the storage descriptor.

        ! *** leave up to byte 34 inclusive for _NT_STORAGE field.

        MC_SAT_STORAGE  = [ 35,0, 8,0 ],        ! Vector storage descriptor for SAT records.
                                                ! A direct reference to this field is
                                                !  equivalent to the STOR_LONG_PTRS
                                                !  field of the storage descriptor.

        ! *** leave up to byte 41 inclusive for _SAT_STORAGE field.
```

```
        MC_LVT_STORAGE  = [ 42,0, 8,0 ],        ! Vector storage descriptor for LVT records.
                                                ! A direct reference to this field is
                                                !  equivalent to the STOR_LONG_PTRS
                                                !  field of the storage descriptor.

        ! *** leave up to byte 48 inclusive for _LVT_STORAGE field.

        MC_STATICS      = [ 49,0,32,1 ],        ! Number of SAT records required.
        MC_LITERALS     = [ 53,0,32,1 ],        ! Number of LVT records required.
        MC_GBL_SAT_PTR  = [ 53,0,32,0 ]         ! Pointer to the single 'fake'
                                                ! SAT record for globals. NOTE:
                                                ! _SAT_PTR and _LITERALS are
                                                ! mutually exclusive.
    TES;

!+
! You declare an occurrence or REF of an MC datum via:
!-

MACRO
        MC_RECORD       = RST_MC[ RST_MC_SIZE, BYTE ] FIELD( MC_FIELD_SET ) %;
```

```
!++
!  The Name Table (NT) is a set of doubly-linked records
!  with the following format:
!
!        !<byte><byte>'<byte><byte>!
!
!        !------------!------------!
!        !x!flags!type! Next NT     !
!        !------------!------------!
!        !       DST Pointer        !
!        !------------!------------!
!        ! back hash  !  forw hash  !
!        !------------!------------!
!        ! first name bytes ! count !
!        !------------!------------!
!        !     more  name  bytes    !
!        !------------!------------!
!        !     more  name  bytes    !
!        !------------!------------!
!        !     more  name  bytes    !
!        !------------!------------!
!
!  Since access to such records will be via so-called RST-pointers,
!  (16-bit pointers which we always add a global to before using),
!  we define the following structure to localize this implementation
!  detail.
!--

LITERAL
        RST_NT_OVERHEAD = 13,   ! Number of bytes in NT record excluding those
                                !   taken up by the name.  (So that this
                                !   number + .NT_PTR[ NT_NAMES_CS ] gives
                                !   the length of the NT record in bytes.)
                                !  (This is solely for the benefit of routines
                                !   unlink_nt_recs, add_nt, and add_gst_nt.)
        PST_NT_SIZE     = 44;   ! A static NT record would take a max # of bytes.
                                ! (Dynamically-allocated ones usually take less).

STRUCTURE
        RST_NT [ off, pos, siz, ext; N=1, unit=1 ] =
                [ N * RST_NT_SIZE ]

                BEGIN
                (
                EXTERNAL PAT$GL_RST_BEGN;
                RST_NT + .PAT$GL_RST_BEGN
                ) + off*unit
                END <pos, siz, ext>
                ;

!+
!  Access to an NT chain is via a 'hash' vector.
!  Conceptually, this is a vector of RST-pointers, and
!  we define the following macro to declare REFs or occurrences
!  of these elements.  (because we may decide
!  to change their representation)
```

```
!-

MACRO
        NT_HASH_RECORD = VECTOR[1,WORD] %;


!+
!  NT records have the following fields.
!
!  Note that NT_FORWARD must be the first
!  field in the record so that unlink_nt_recs
!  can overlay NT_FORWARD and a given entry
!  in the NT_HASH_VECTOR.
!-

FIELD
        NT_FIELD_SET =
    SET
        ! **** Some fields (up to NAME_ADDR) must be alligned
        !      with the corresponding ones in RST_MC structures.

        NT_FORWARD      = [  0,0,16,0 ],        ! Next NT record in hash chain.
                                                !  FORWARD must be first.  See above.
        NT_TYPE         = [  2,0, 8,0 ],        ! DST record type byte, (from SRM),
                                                ! or unused if NT_IS_GLOBAL.
        NT_IS_GLOBAL    = [  3,0, 1,1 ],        ! Whether or not the symbol is GLOBAL.
        NT_NOT_FREE     = [  3,1, 6,0 ],        ! Used in MCs but not in NTs.
        NT_IS_BOUNDED   = [  3,7, 1,0 ],        ! Unsed in NTs only.  => symbol's
                                                !   LB and UB are not 0.
        NT_DST_PTR      = [  4,0,32,0 ],        ! Pointer to associated DST record.
        NT_GBL_VALUE    = [  4,0,32,0],         ! Value of symbol when it is
                                                ! bound only to a GST record.
        NT_UP_SCOPE     = [  8,0,16,0 ],        ! Pointer to NT record for symbol
                                                !   that is 'above' this as far as
                                                !   scope is concerned.
        NT_BACKWARD     = [ 10,0,16,0 ],        ! Backward NT hash chain link.
        NT_NAME_CS      = [ 12,0, 8,0 ],        ! Name of symbol is a counted string.
                                                ! A dotted reference to this field picks
                                                ! up the count, an undotted one
                                                ! addresses the counted string.
        NT_NAME_ADDR    = [ 13,0, 8,0 ]         ! The name string itself.  An undotted
                                                ! reference to this field addresses
                                                ! only the MC name, a dotted reference
                                                ! picks up the 1st character of the name.

    TES;


!+
! You define an occurrence or REF to an NT record via:
!-

MACRO
        NT_RECORD       = RST_NT[ RST_NT_SIZE, BYTE] FIELD( NT_FIELD_SET ) %;
```

```
!++
! The Static Address Table (SAT) is a vector of
! fixed-size records (blocks) with the following
! format:
!
!       !<byte><byte>!<byte><byte>!
!
!                     !------------!
!                     ! NT-pointer !
!                     !------------!------------!
!                     !  lower bound address    !
!                     !------------!------------!
!                     !  upper bound address    !
!                     !------------!------------!
!
! The lower and upper bound address fields contain the
! beginning and ending virtual addresses which were
! bound to the symbol by the linker.
! The NT-pointer field contains an RST-pointer into
! the name table (NT) for the NT entry which corresponds
! to this symbol.
!
! Overall Structure:
!
!       Logically, the SAT is a sequence of fixed-size records
! ordered on the _UB field so that we can search them sequentially.
! Physically the storage is actually discontiguous,
! space being associated with the module the space was allocated
! on behalf of.  Sequentially access to the SAT is that which
! is provided and defined by GET_NEXT_SAT in the following
! manner:
!
!       1) call GET_NEXT_SAT( SL_ACCE_INIT )
!
!          to set up to begin scanning the SAT
!  then
!       2) call ptr = GET_NEXT_SAT( access_type )
!
!          to have 'ptr' set to the next SAT record, where
!          the notion of 'next' is defined by 'access_type'.
!
!       Currently 3 access_types are defined.  _RECS and _SORT both
! ask for the next sequential record in a logical sense.  (i.e.
! records marked for deletion are quietly skipped over).  The ending
! criterion for _RECS access is that there are no more records left,
! while _SORT access, expected to be used with the 'shell' sort,
! ends each time like _RECS does but at that time causes
! the access routine to restore the context which it saved after
! the last _SORT call so that subsequent _RECS calls scan from
! where they left off last time.
! In both cases 0 is returned in 'ptr' when
! there are no more records for the indicated access type.
!
!       For the type of sequential access we need when moving
!  endangered SAT/LVT records to storage not _DYING,
!  we also define a third access mode called SL_ACCE_FREE.
```

```
!   This mode asks for modules _IN_RST AND _IS_DYING to
!   be skipped over so that only pointers to 'safe' records
!   are returned.
!
!       In all cases, the same _INIT code must be used to
!   'start off' the access sequence, and no concurrent accessing
!   is allowed except for the limited type supported via RECS/SORT.
!--

LITERAL
        SL_ACCE_INIT    = 0,    ! See above.   "SL" --> SAT/LVT
        SL_ACCE_RECS    = 1,
        SL_ACCE_SORT    = 2,
        SL_ACCE_FREE    = 3;

!+
! SAT/LVT Correspondence
!
!       While the SAT and LVT are as similar in structure as they
! are now, the two are manipulated by the same routines as much
! as possible.  This will remain OK as long as the fields which
! must correspond still do.  See the "Implicit Inputs" section
! of the common routines for details.
!-

!+
!  SAT records have the following fields.
!-

FIELD
        SAT_FIELD_SET =
    SET
        ! **** The SAT and LVT structures must be alligned so that
        !      the _NT_PTR fields match, and so that the _LB and _VALUE
        !      fields overlap.  The latter must be true only as long
        !      as the two share a common sort routine which relies on
        !      this allignment.  The former must be true as long as
        !      the two share any routines which access SAT_NT_PTR
        !      (COMPRES_SAT_LVT, DELE_SAT_LVT, etc).

        SAT_NT_PTR      = [  0,0,16,0 ],        ! Points to associated NT record.
        SAT_LB          = [  2,0,32,0 ],        ! Lower bound static address.

        SAT_UB          = [  6,0,32,0 ]         ! Upper bound static address.
    TES,

!+
! You declare an occurrence or REF of an SAT datum via
! the macro, SAT_RECORD.  If you want the %SIZE of
! a pointer to such a thing, use %size( SAT_POINTER ).
!-

LITERAL
        RST_SAT_SIZE    = 10;   ! Each SAT record takes this many bytes.

MACRO
```

```
        SAT_RECORD      = BLOCK[ RST_SAT_SIZE, BYTE ] FIELD( SAT_FIELD_SET ) %,
        SAT_POINTER     = REF BLOCK[ RST_SAT_SIZE, BYTE ] %;                    GL
```

```
!++
! The Literal Value Table (LVT) is a vector of
! fixed-size LVT records each of which has the
! following format:
!
!       !<byte><byte>!<byte><byte>!
!
!                     !------------!
!                     ! NT-pointer !
!       !-------------!------------!
!       !       literal value      !
!       !-------------!------------!
!
! The value field contains the longword value
! which is bound to the literal.
! The NT-pointer is an RST-pointer to the NT record
! for this symbol.
!
! Overall Structure:
!
!       Logically, the LVT is a sequence of fixed-size records
! ordered on the _VALUE field so that we can search them sequentially.
! Physically the storage is actually discontiguous,
! space being associated with the module the space was allocated
! on behalf of.  Sequentially access to the LVT is that which
! is provided and defined by GET_NEXT_LVT using the same
! control literals and the same mechanisms as are described
! for the SAT, above.
!--

!+
!  LVT records have the following fields.
!-

FIELD
        LVT_FIELD_SET =
    SET
        ! **** The SAT and LVT structures must be alligned so that
        !       the _NT_PTR fields match, and so that the _LB and _VALUE
        !       fields overlap.  The latter must be true only as long
        !       as the two share a common sort routine which relies on
        !       this allignment.  The former must be true as long as
        !       the two share any routines which access SAT_NT_PTR
        !       (COMPRES_SAT_LVT, DELE_SAT_LVT, etc).

        LVT_NT_PTR      = [  0,0,16,0 ],        ! Pointer to associated NT record.
        LVT_VALUE       = [  2,0,32,0 ]         ! Value bound to the literal.
    TES;

!+
! You declare an occurrence or REF of an LVT datum via:
!-

LITERAL
        RST_LVT_SIZE    = 6;    ! Each LVT record takes this many bytes.
```

```
MACRO
        LVT_RECORD      = BLOCK[ RST_LVT_SIZE, BYTE ] FIELD( LVT_FIELD_SET ) %;
```

```
!++
! The format of DST records is defined as a BLOCK
! (even though the records are variable sized)
! with the following fields:
!--

FIELD
        DSTR_FIELD_SET =
    SET
        DSTR_SIZE       = [  0,0, 8,0 ],        ! First byte is record size in bytes.
        DSTR_TYPE       = [  1,0, 8,0 ],        ! Type of DST record.
        DSTR_ACCESS     = [  2,0, 8,1 ],        ! Access field.

                !++
                ! Subfields of _ACCESS are offset from the beginning
                ! of the DSTR record.
                !--
                DSTR_ACCES_TYPE = [ 2,0, 2,0 ], ! Type of access
                DSTR_ACCES_BASD = [ 2,2, 2,0 ], ! Based or not
                DSTR_ACCES_BREG = [ 2,4, 4,0 ], ! Associated register

        DSTR_ACC01      = [  2,0, 2,0 ],        ! Access field bits 0+1.
        DSTR_ACC23      = [  2,2, 2,0 ],        ! Access field bits 2+3.
        DSTR_ACC47      = [  2,4, 4,0 ],        ! Access field bits 4-7.
        DSTR_VALUE      = [  3,0,32,1 ]         ! Value field contains various things,
                                                ! but they are always longwords.
        DSTR_NAME       = [  7,0, 8,0 ]         ! The symbol name field is a counted string.
                                                ! (The field ref picks up the count.)
    TES;

!+
! You declare an occurrence or REF of a DST datum via:
!-

LITERAL
        DST_RECORD_SIZE = 23;   ! Each DST record is at most 23 bytes long.

MACRO
        DST_RECORD = BLOCK[ DST_RECORD_SIZE, BYTE] FIELD( DSTR_FIELD_SET ) %;


!++
! The DST record types are defined in SRM as 'system-wide' names.
! The fields for the DSC structure are:

        dsc$w_length    = 0, 0, 16, 1%,         ! length of string
        dsc$b_dtype     = 2, 0, 8, 0%,          ! type of data
        dsc$b_class     = 3, 0, 8, 0%,          ! type of descriptor
        dsc$a_pointer   = 4, 0, 32, 0%,         ! address of string
        dsc$w_maxlen    = 8, 0, 16, 1%,         ! maximum length of string

        dsc$b_aflags    = 10, 0, 8, 0%,         ! array flag bits
        dsc$v_fl_column = 10, 5, 1, 0%,         ! FORTRAN array element storage
        dsc$v_fl_coeff  = 10, 6, 1, 0%,         ! coefficients present
        dsc$v_fl_bounds = 10, 7, 1, 0%,         ! bounds information present
        dsc$b_dimct     = 11, 0, 8, 0%,         ! number of dimensions
```

```
!       dsc$l_arsize    = 12, 0, 32, 0%,        . total size of array in bytes
!       dsc$a_a0        = 16, 0, 32, 0%,        . address of element A (0, 0, ... )
!       dsc$l_m1        = 20, 0, 32, 0%;        . addressing coefficients

!LITERAL
!       dsc$k_class_a   = 4;                    ! class = descriptor


! We divide these types essentially into 3 classes
! because when we are interested in what type a record
! is we usually want to first divide the range into
!       1) BLISS type ZERO,
!       2) SRM atomic types (1-23),
! and
!       3) 'the rest' - those which exist for DEBUG and PATCH only.
! This is what the _HIGHEST and _LOWEST symbols are for.
!-

!MACRO
!       DSC$W_MAXLEN    = 8, 0, 16, 1%; ! MAXIMUM LENGTH OF STRING FOR DESCRIPTOR

LITERAL

        ! Variable types:

!       DSC$K_DTYPE_Z   = 0,    ! Unspecified.

!       DSC$K_DTYPE_V   = 1,    ! Bit.
!       DSC$K_DTYPE_BU  = 2,    ! Byte logical.
!       DSC$K_DTYPE_WU  = 3,    ! Word logical.
!       DSC$K_DTYPE_LU  = 4,    ! Longword logical.
!       DSC$K_DTYPE_QU  = 5,    ! Quadword logical.
!       DSC$K_DTYPE_B   = 6,    ! Byte integer.
!       DSC$K_DTYPE_W   = 7,    ! Word integer.
!       DSC$K_DTYPE_L   = 8,    ! Longword integer.
!       DSC$K_DTYPE_Q   = 9,    ! Quadword integer.
!       DSC$K_DTYPE_F   = 10,   ! Single-precision floating.
!       DSC$K_DTYPE_D   = 11,   ! Double-precision floating.
!       DSC$K_DTYPE_FC  = 12,   ! Complex.
!       DSC$K_DTYPE_DC  = 13,   ! Double-precision Complex.
!       DSC$K_DTYPE_T   = 14,   ! ASCII text string.
!       DSC$K_DTYPE_NU  = 15,   ! Numeric string, unsigned.
!       DSC$K_DTYPE_NL  = 16,   ! Numeric string, left separate sign.
!       DSC$K_DTYPE_NLO = 17,   ! Numeric string, left overpunched sign.
!       DSC$K_DTYPE_NR  = 18,   ! Numeric string, right separate sign.
!       DSC$K_DTYPE_NRO = 19,   ! Numeric string, right overpunched sign.
!       DSC$K_DTYPE_NZ  = 20,   ! Numeric string, zoned sign.
!       DSC$K_DTYPE_P   = 21,   ! Packed decimal string.
!       DSC$K_DTYPE_ZI  = 22,   ! Sequence of instructions.
!       DSC$K_DTYPE_ZEM = 23,   ! Procedure entry mask.

        DST_TYP_HIGHEST = 23,   ! Highest TYPE type we support.
                                ! (for range checking)

        ! DST Record Types:
```

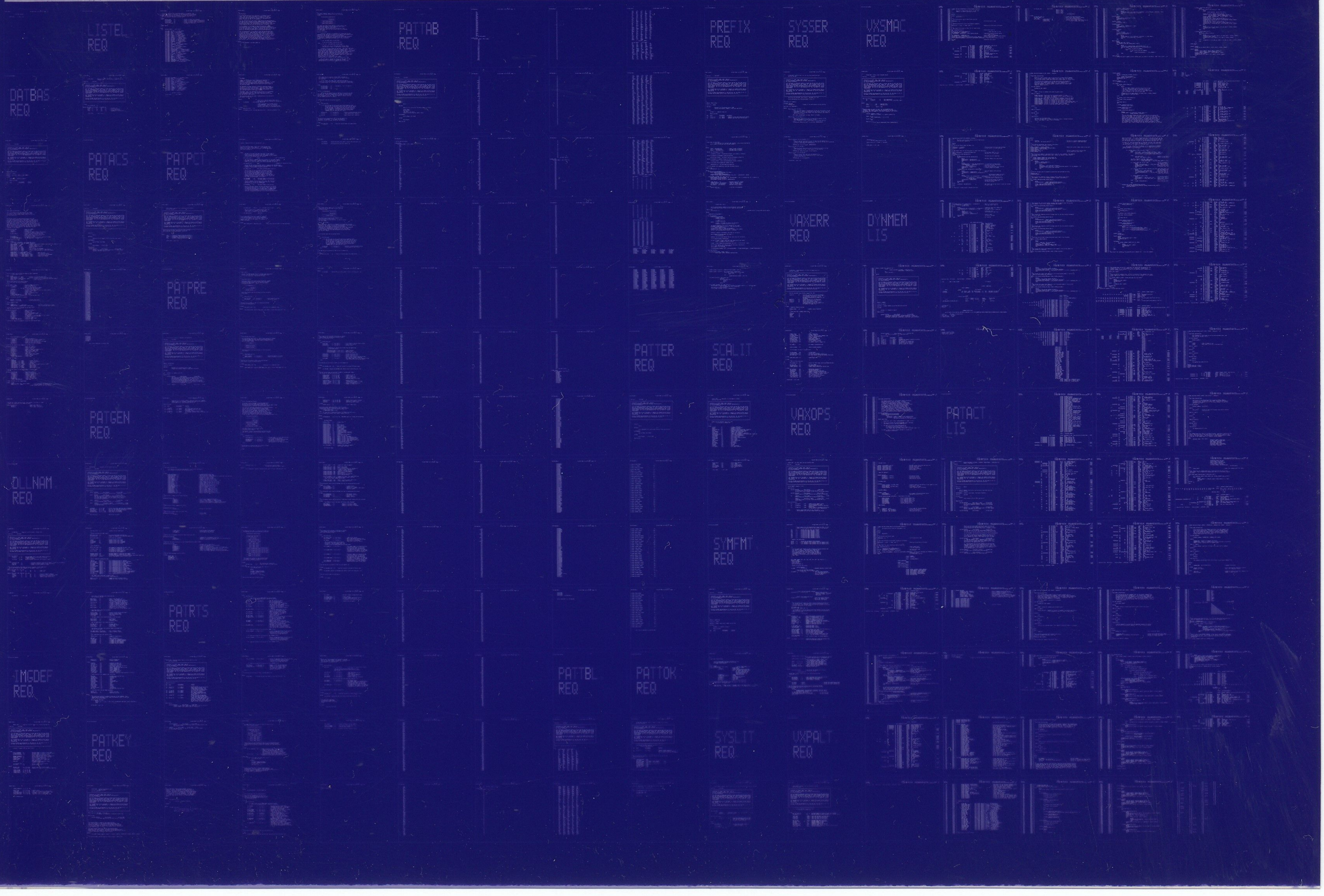
```
        DST_DST_LOWEST  = 183,  ! Lowest DST type we support.

!       DSC$K_DTYPE_FLD = 183,  ! BLISS FIELD names.
!       DSC$K_DTYPE_PCT = 184,  ! PSECT information.
!       DSC$K_DTYPE_DPC = 185,  ! PC correlation table for FORTRAN IV+
!       DSC$K_DTYPE_LBL = 186,  ! LITERAL or LABEL, depending on
                                !  another field in the DST.
!       DSC$K_DTYPE_SLB = 187,  ! Labels in non-MARS modules.
!       DSC$K_DTYPE_MOD = 188,  ! Beginning of a new MODULE.
!       DSC$K_DTYPE_EOM = 189,  ! End of Module.
!       DSC$K_DTYPE_RTN = 190,  ! Beginning of a new ROUTINE.
!       DSC$K_DTYPE_EOR = 191,  ! End of ROUTINE marker.

        DST_DST_HIGHEST = 191;  ! Highest DST type. (for range checking)
        ! For now we have our own made-up types to match the GSD
        ! types 'entry' and 'symbol definition'.

!       DSC$K_DTYPE_ENT = 192,  ! ENTRY (routine) global definition
!       DSC$K_DTYPE_GBL = 193;  ! Global symbol definition.

!++
! The DSTR_ACC01 field from DST_RECORDs has the following possible values:
!--
LITERAL
        ACCS_LITERAL    = 0,                    ! Literal value
        ACCS_VALUEADR   = 1,                    ! Address of a value
        ACCS_DESCRIPTOR = 2,                    ! Address of a symbol's descriptor
        ACCS_REGISTER   = 3;                    ! Register number

!++
! The DSTR_ACC23 field from DST_RECORDs has the following possible values:
!--
LITERAL
        ACCS_NOTBASDIR  = 0,                    ! Not-based, direct
        ACCS_NOTBASIND  = 1,                    ! Not-based, indirect
        ACCS_BASDIR     = 2,                    ! Based, direct
        ACCS_BASIND     = 3;                    ! Based, indirect

!++
! The following literals define various fixed-value fields found within DST records.
!--
LITERAL
        ! Each MODULE record indicates the source code language:

        MARS_MODULE     = 0,            ! Module is written in MARS.
        BLISS_MODULE    = 2,            ! Module is written in BLISS.
        FORTRAN_MODULE  = 1;            ! Module is written in FORTRAN.
```

```
!++
! The format of GST records is defined as a BLOCK
! (even though the records are variable sized)
! with the following fields:
!--

FIELD
        GST_FIELD_SET =
    SET
        GST_ENTRY_TYPE  = [  0,0, 8,0 ],        ! Type of GST record.
        GST_IS_DEFN     = [  2,1, 1,0 ],        ! This flag implies whether o no
                                                ! the record is an entry definition.
        GST_VALUE       = [  5,0,32,0 ],        ! The value of the global.
                                                ! (This won't work for PSECTs)
        ! The following 2 pairs are mutually
        ! exclusive.  The first one is for GST
        ! records of type GST_GLOBAL_DEFN, the
        ! second is for GST_ENTRY_DEFN and GST_PROC_DEFN.

        GST_G_NAME_CS   = [ 9,0, 8,0 ],         ! The symbol name is a counted string.
                                                ! A dotted reference to this field
                                                ! picks up the count, an undotted
                                                ! one addresses the counted string.
        GST_G_NAME_ADDR = [10,0, 8,0 ],         ! The name string itself.  An undotted
                                                ! reference is the address of the name,
                                                ! a dotted one is the 1st character.


        GST_E_NAME_CS   = [11,0, 8,0 ],         ! The entry name is a counted string.
                                                ! A dotted reference to this field
                                                ! picks up the count, an undotted
                                                ! one addresses the counted string.
        GST_E_NAME_ADDR = [12,0, 8,0 ],         ! The name string itself.  An undotted
                                                ! reference is the address of the name,
                                                ! a dotted one is the 1st character.
        GST_P_MAX_ARG   = [1,0, 8,0 ],          ! Maximum number of formal arguments.
        GST_P_REM_CNT   = [1,0, 8,0 ]           ! Remaining byte count in arg. desc.
    TES;

!+
! You declare an occurrence or REF of a GST datum via:
!-

LITERAL
        GST_RECORD_SIZE = 27;   ! Each GST record is at most 27 bytes long.

MACRO
        GST_RECORD = BLOCK[ GST_RECORD_SIZE, BYTE] FIELD( GST_FIELD_SET ) %;


!+
! The GST record types are defined as:
!-

LITERAL
        ! GST types:
```

```
        GST_LOWEST      = 1,            ! We don't support global PSECTs now.

        GST_PSECT_DEFN  = 0,            ! P-SECT record.
        GST_GLOBAL_DEFN = 1,            ! A global symbol definition record.
        GST_ENTRY_DEFN  = 2,            ! An entry point definition.
        GST_PROC_DEFN   = 3,            ! A procedure with formal arg. desc.

        GST_HIGHEST     = 3;            ! Highest one we support.
```

```
!++
! BLISS uses 'non-standard' DST records to encode
! most of its local symbol information.  These records
! are like most DST records except that the TYPE
! information is variable-sized.
!--

FIELD
        BLZ_FIELD_SET =
    SET
        BLZ_SIZE        = [  0,0, 8,0 ],        ! First byte is record size in bytes.

                          ! The next byte contains DSC$K_DTYPE_Z, or we
                          ! wouldn't be applying this structure to a given
                          ! DST record.

        BLZ_TYP_SIZ     = [  2,0, 8,0 ],        ! Type info takes up this
                                                !  many bytes.
        BLZ_TYPE        = [  3,0, 8,0 ],        ! Which type of type Zero
                                                !  this corresponds to.
        BLZ_ACCESS      = [  4,0, 8,0 ],        ! Access field.
        BLZ_STRUCT      = [  5,0, 8,0 ],        ! Type of STRUCTURE reference.

                ! **** The following only work when BLZ_TYP_SIZ is 3.

        BLZ_VALUE       = [  6,0,32,0 ],        ! DST VALUE field.
        BLZ_NAME_CS     = [ 10,0, 8,0 ],        ! The symbol name is a counted string.
                                                ! A dotted reference to this field
                                                ! picks up the count, an undotted
                                                ! one addresses the counted string.
        BLZ_NAME_ADDR   = [11,0, 8,0 ]          ! The name string itself.  An undotted
                                                ! reference is the address of the name,
                                                ! a dotted one is the 1st character.
    TES;

!+
! You declare a REF to a BLZ_DST datum via:
!-

LITERAL
        BLZ_REC_SIZ     = 38;   ! Each DST record is at most 38 bytes long.

MACRO
        BLZ_RECORD = BLOCK[ BLZ_REC_SIZ, BYTE] FIELD( BLZ_FIELD_SET ) %;


!+
! The type zero sub types,
! as defined in CP0021.MEM
! must be within the following
! range.
!-

LITERAL

        ! Type Zero Sub-Types:
```

```
        BLZ_LOWEST      = 1,    ! Lowest variable type we support.

        BLISS_Z_FORMAL  = 1,    ! Description of a ROUTINE formal.
        BLISS_Z_SYMBOL  = 2,    ! A BLISS LOCAL symbol.

        BLZ_HIGHEST     = 2;    ! Highest variable type we support.
```

++
End of PATRTS.REQ
--

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